

Modular RICH Beam Test – eRD14 (EIC PID Consortium)

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Why am I interested in giving this presentation ?

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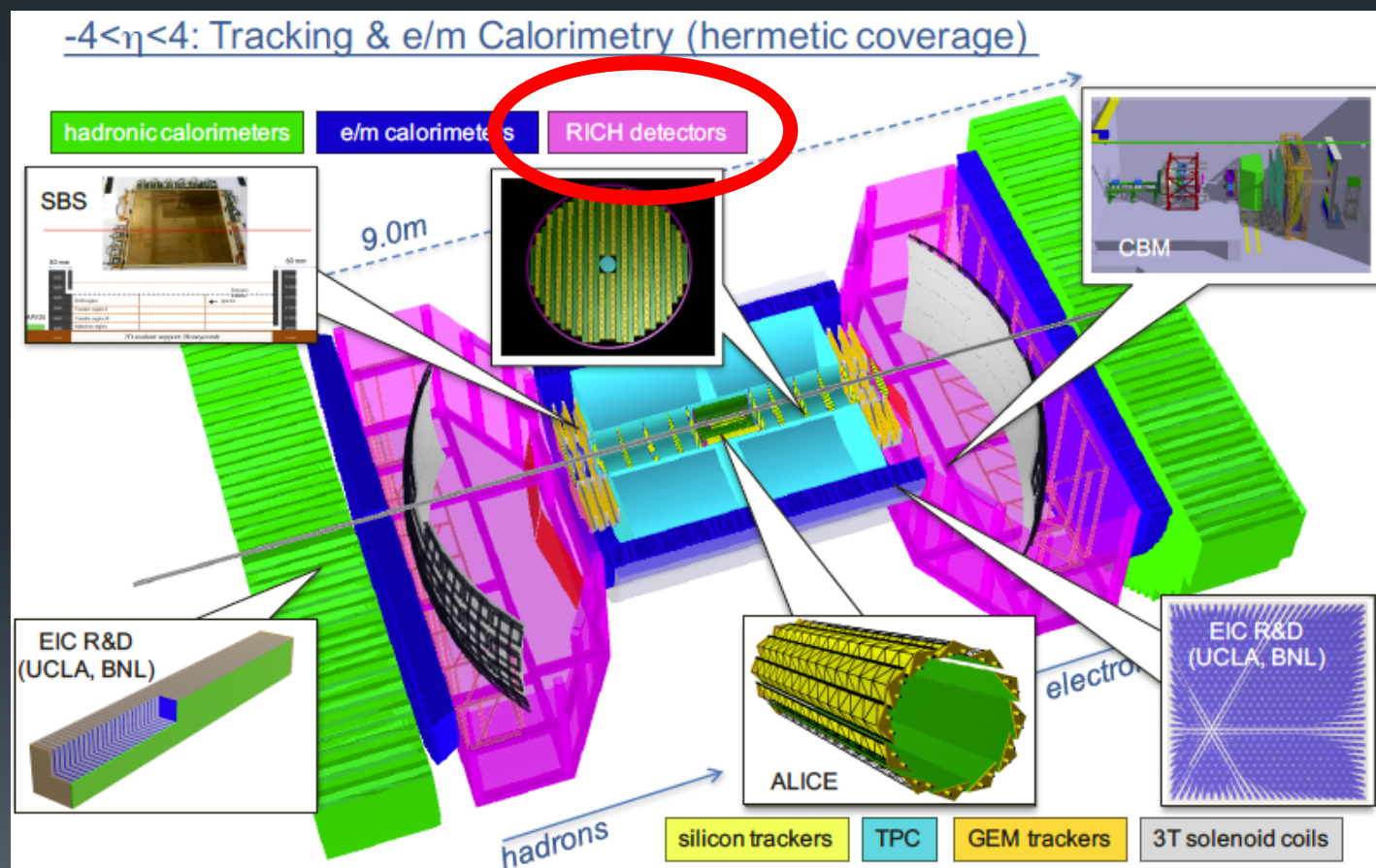
- This is a follow-up presentation about a modular RICH (mRICH) detector proposed for the EIC PID (eRD14) project. The first presentation was given in this meeting series by Liang Xue on May 19, 2015. See the link - <https://indico.bnl.gov/conferenceDisplay.py?confId=1165>
- Over the past year, a significant effort has been made for designing and building a prototype mRICH at GSU. A very successful beam test of this prototype was done from April 18 – 29, 2016 at Fermilab.
- A plan for the second prototype test is underway with improved detector design and finer photosensor readout.
- I hope that one may find home for this new detector design in the context of fsPHENIX.

eRD14 - EIC PID consortium

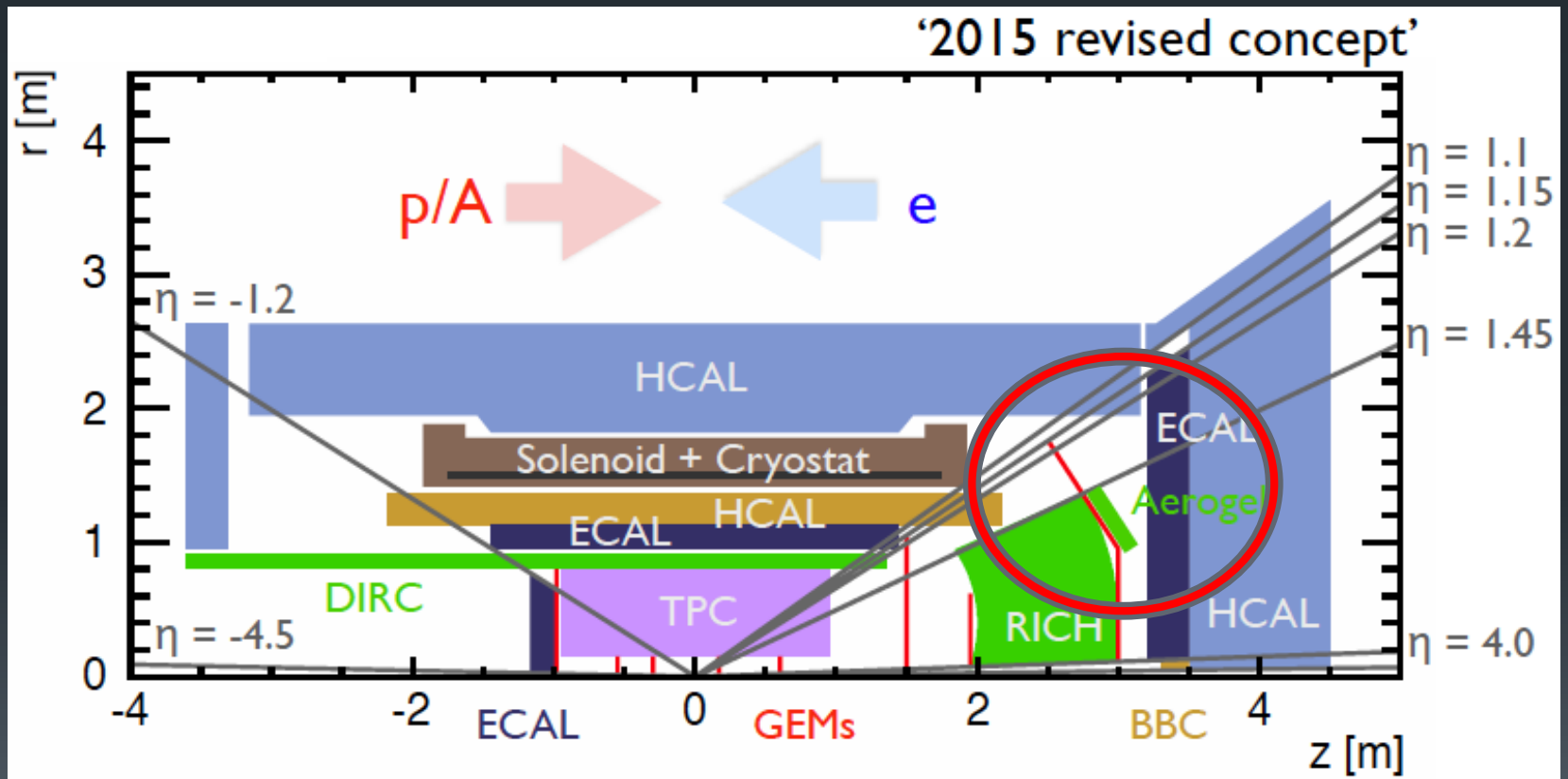
- An integrated program for particle identification (PID) for a future Electron-Ion Collider (EIC) detector.

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BNL Version of an EIC Detector



fsPHENIX



From Liang's Presentation

Modular RICH In GEMC

1) A block of aerogel.

- SiO_2 , 0.02 g/cm³
- Refractive index: $n=1.025$

2) Fresnel lens

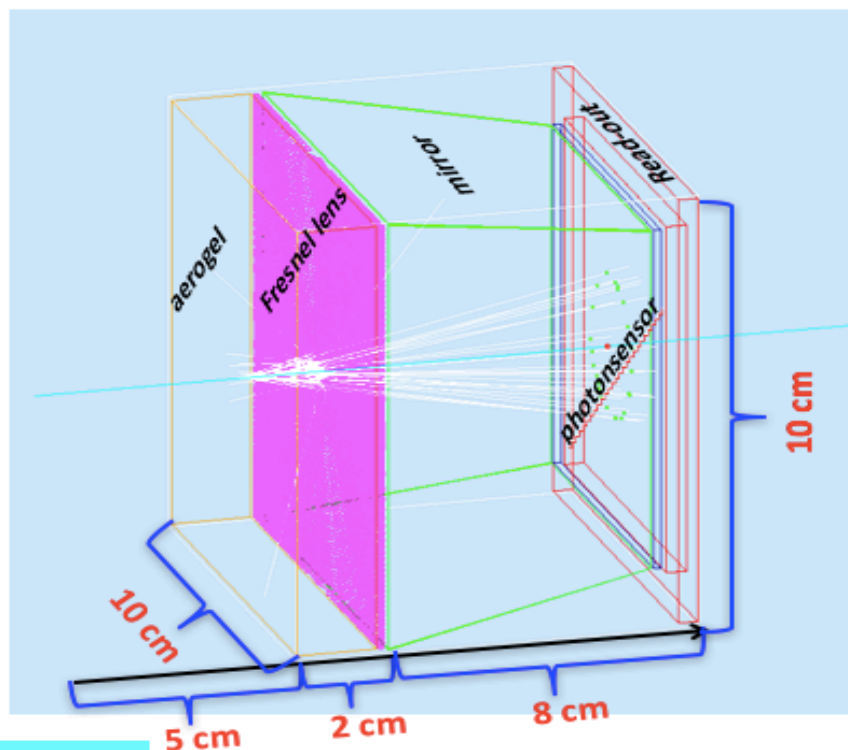
- Acrylic, $\text{C}_5\text{H}_8\text{O}_2$, 1.19 g/cm³
- Four sections, G4Polycon
- 100 grooves, good focusing

3) Mirrors

- Four sections: front, back, top and bottom
- Reflectivity index : 0.95

4) Photosensor and read-out

- Block of aluminum



Fully implemented in GEMC framework

Much Improved Simulation

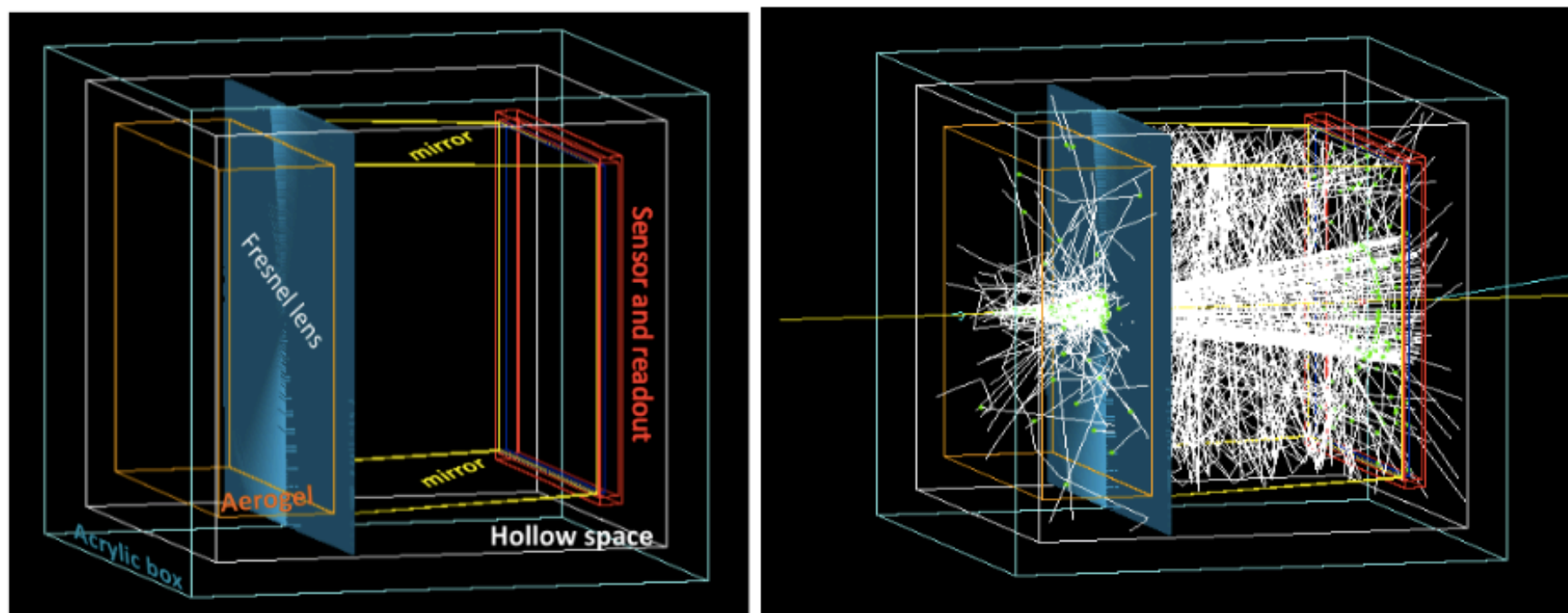


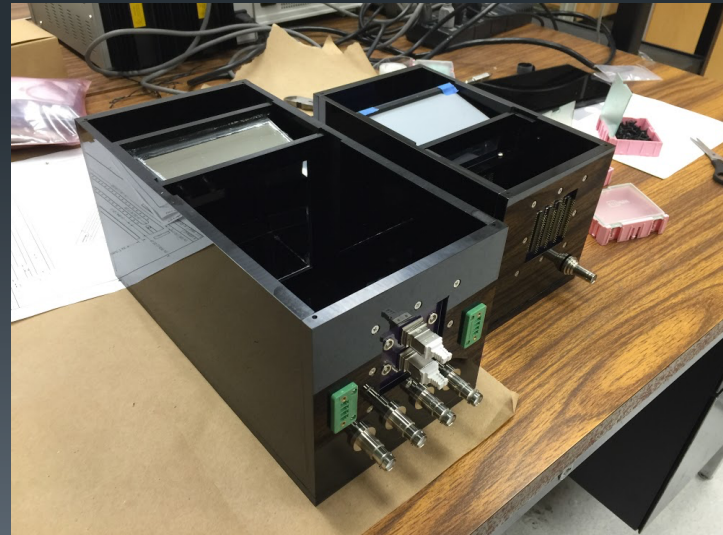
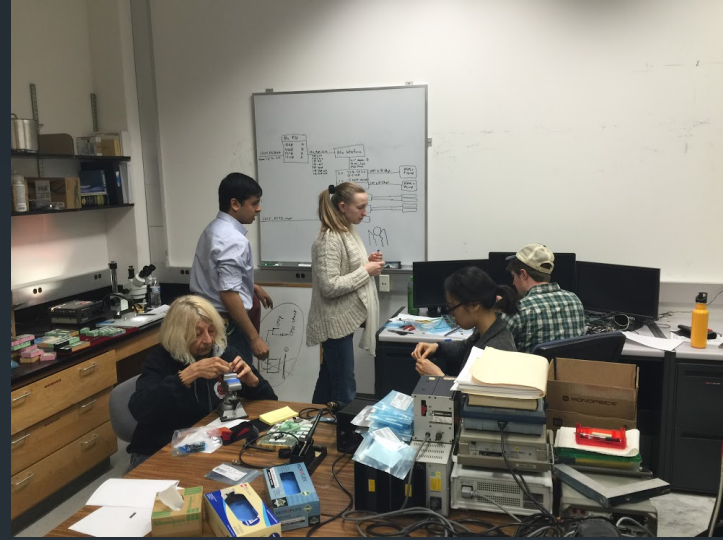
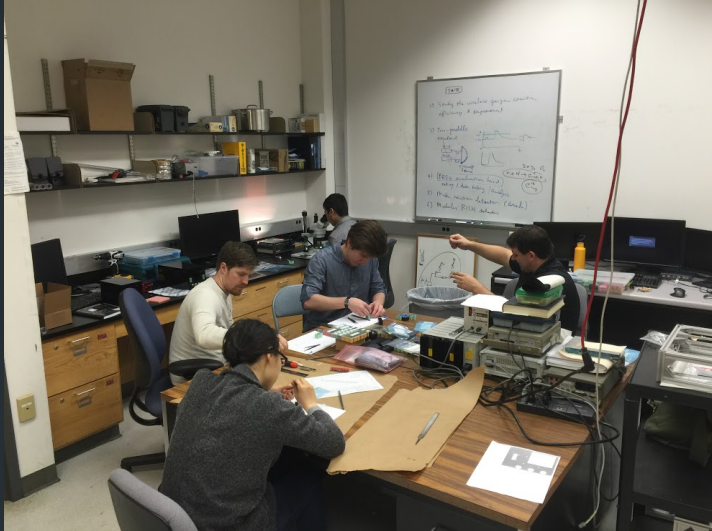
Figure 2.3.1 (Left) Modular RICH detector geometry in GEMC simulation. (Right) Event display from 9 GeV charged pions in GEMC simulation.

Made @ GSU – Fantastic Training for Students

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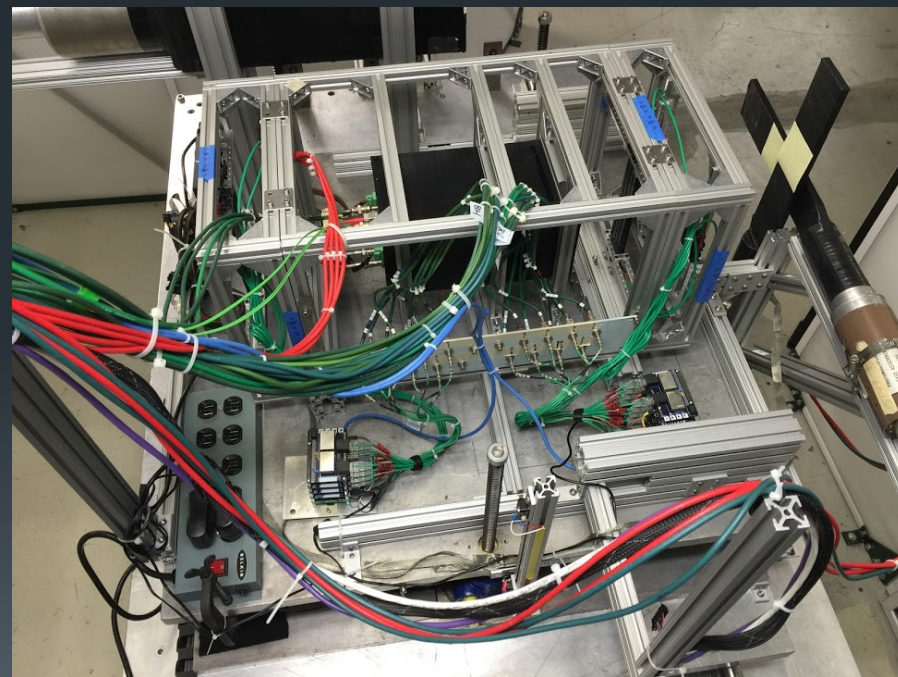
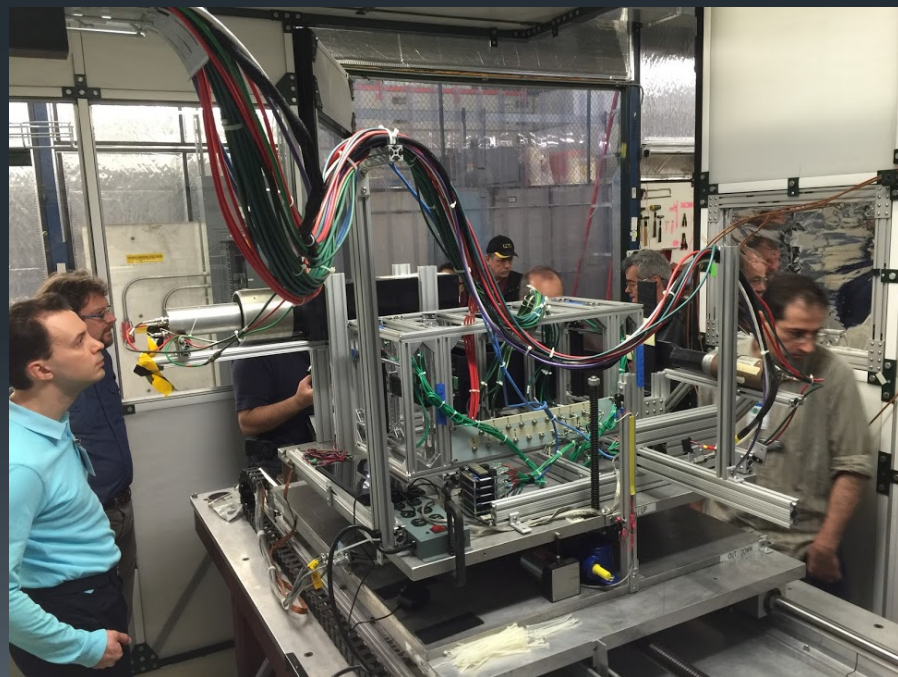


Assemble the mRICH at Fermilab

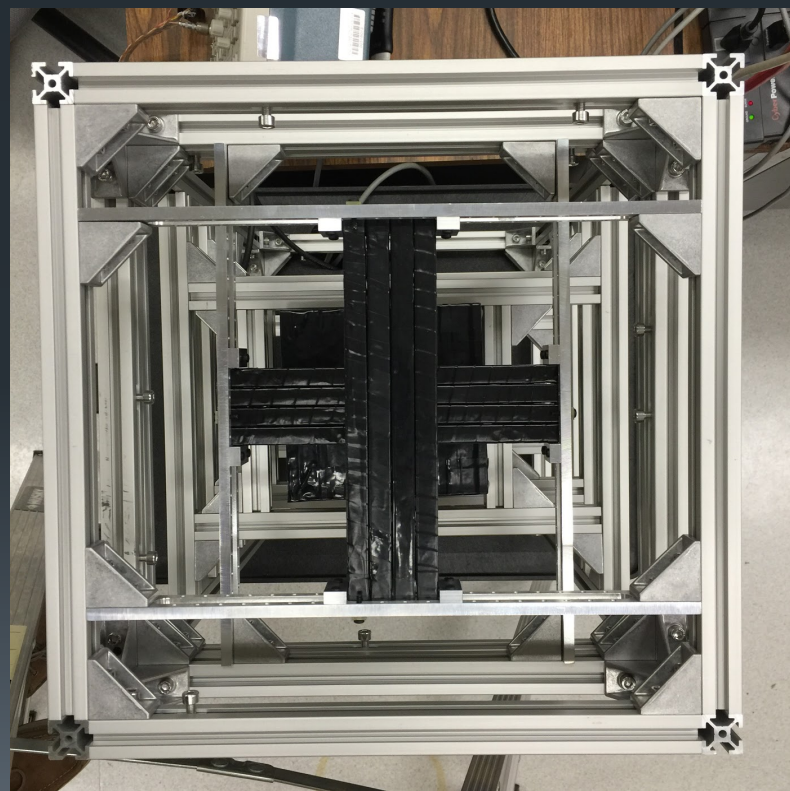
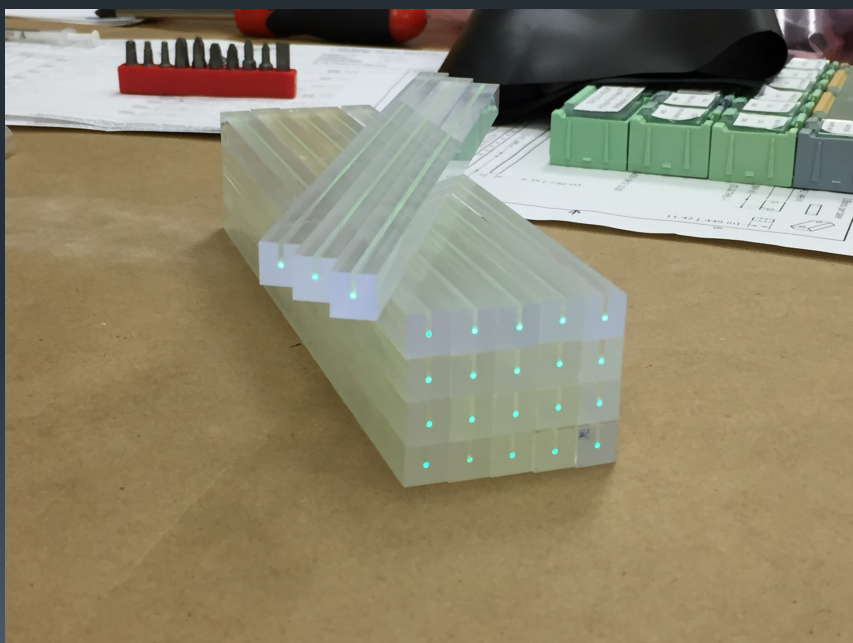
- Photosensors were readout by INFN group



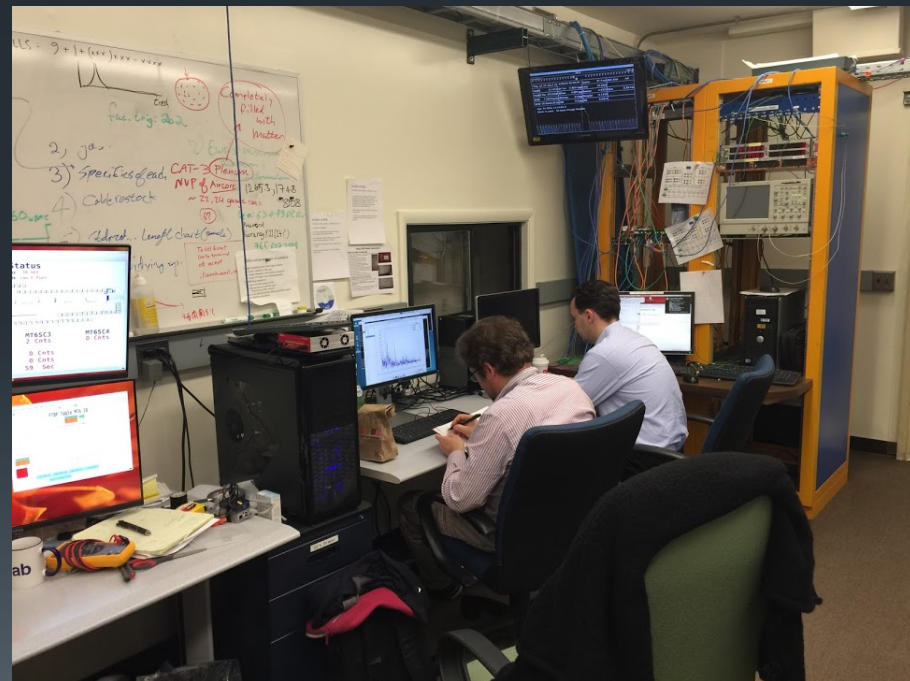
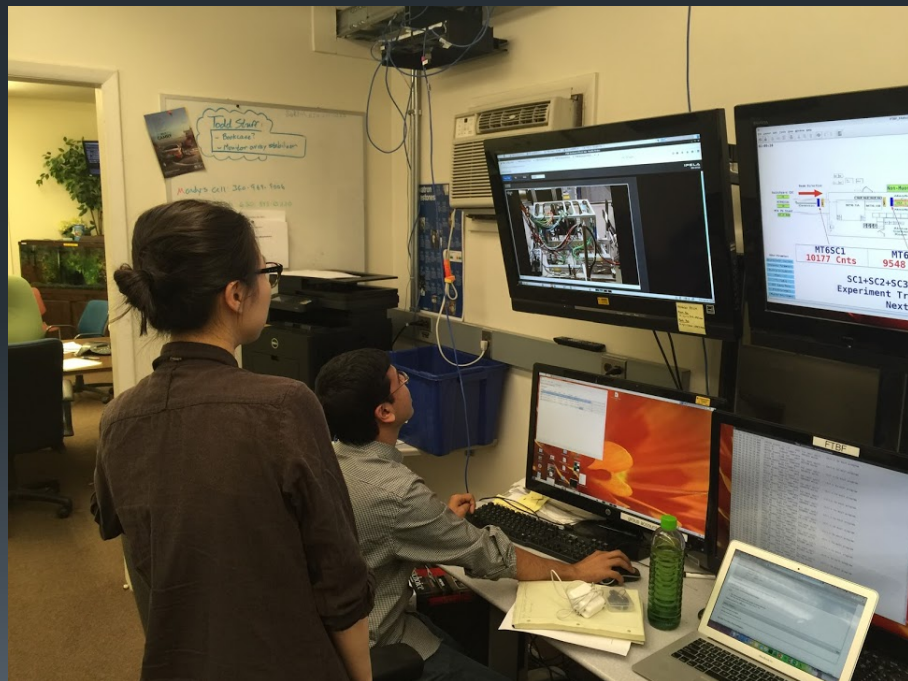
Setting up mRICH at M6 Test Beam Line



Beam Hodoscope



Working in the Counting House



Ring Image from 120 GeV Primary Proton Beam

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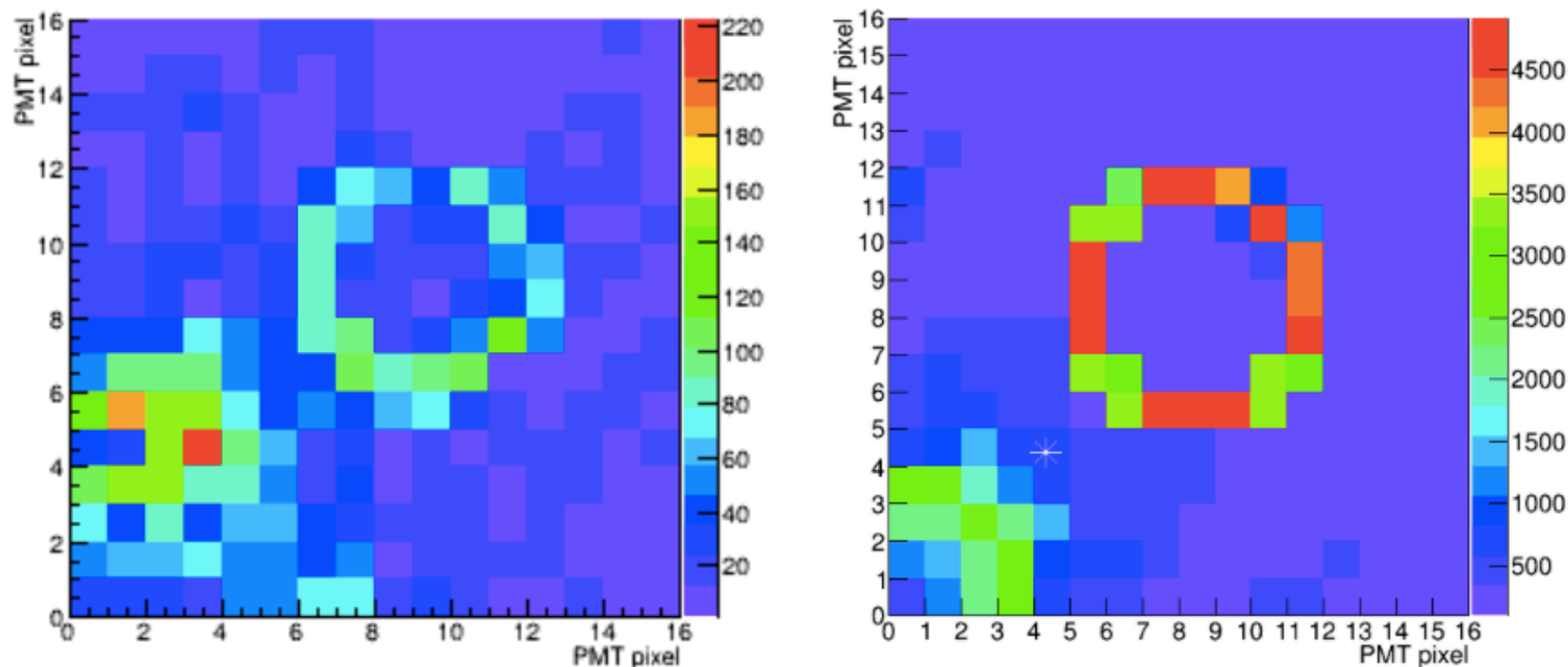


Figure 2.2.3.5 Comparison of beam test result (left) to simulation result (right) from a 120 GeV proton beam. The beam hit in the lower-left quadrant (marked with asterisk) of the mRICH and the produced Cherenkov ring was focused to the center of the sensor plane by the fresnel lens.

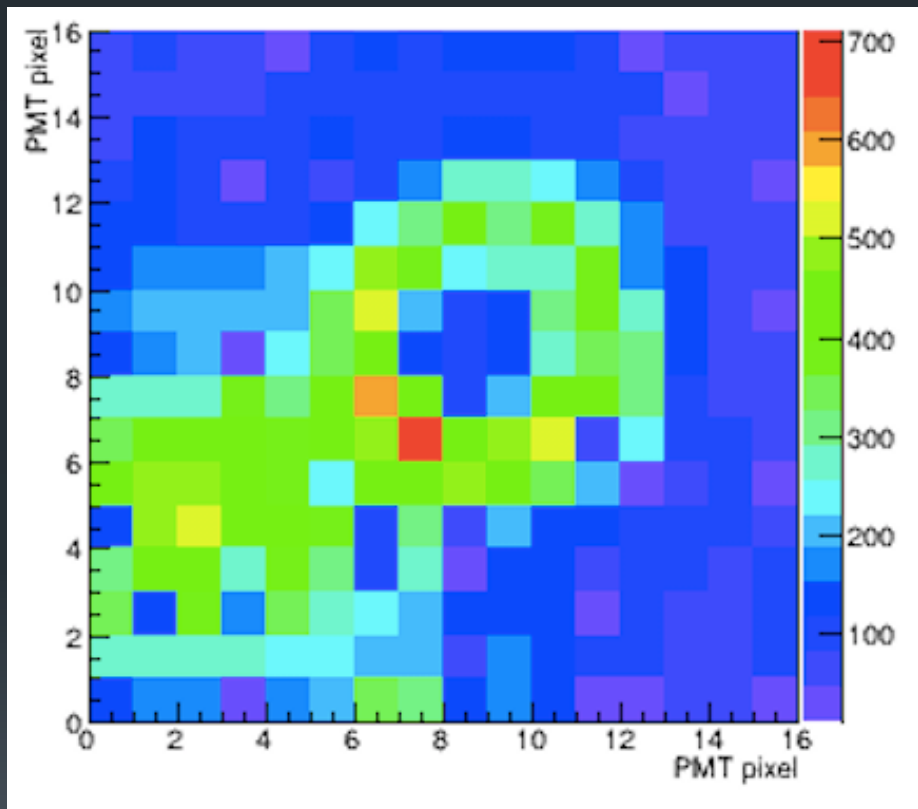
Ring Images from 8 GeV Pion Beam

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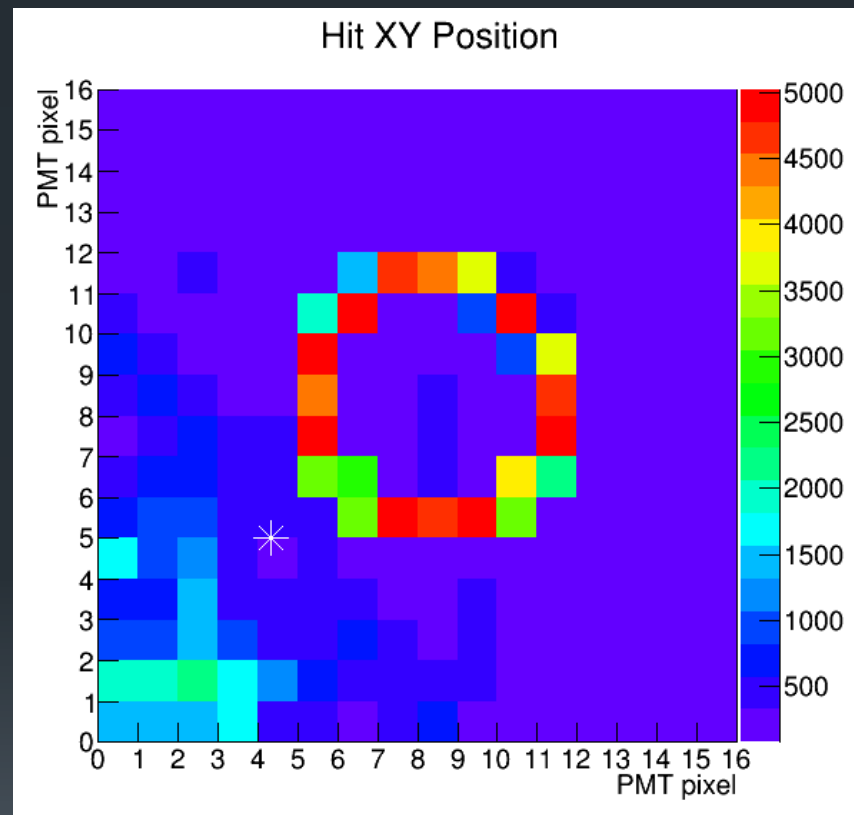
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Cherenkov Image from pion beam



Simulation



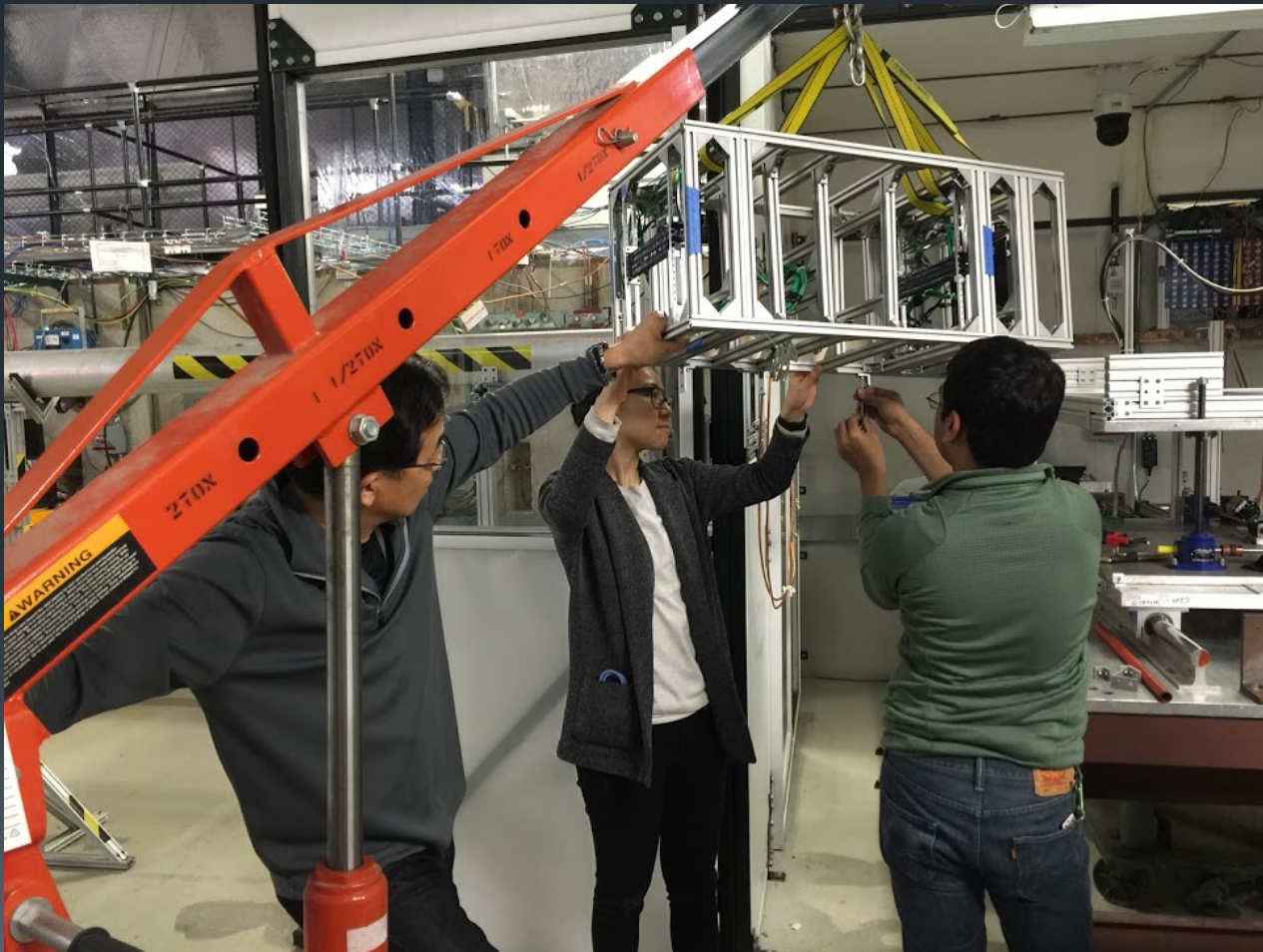
Detailed study just got started. One has to have a relatively good beam direction in order to make comparisons between the data and simulation.

End of the 1st Beam Test on April 29, 2016

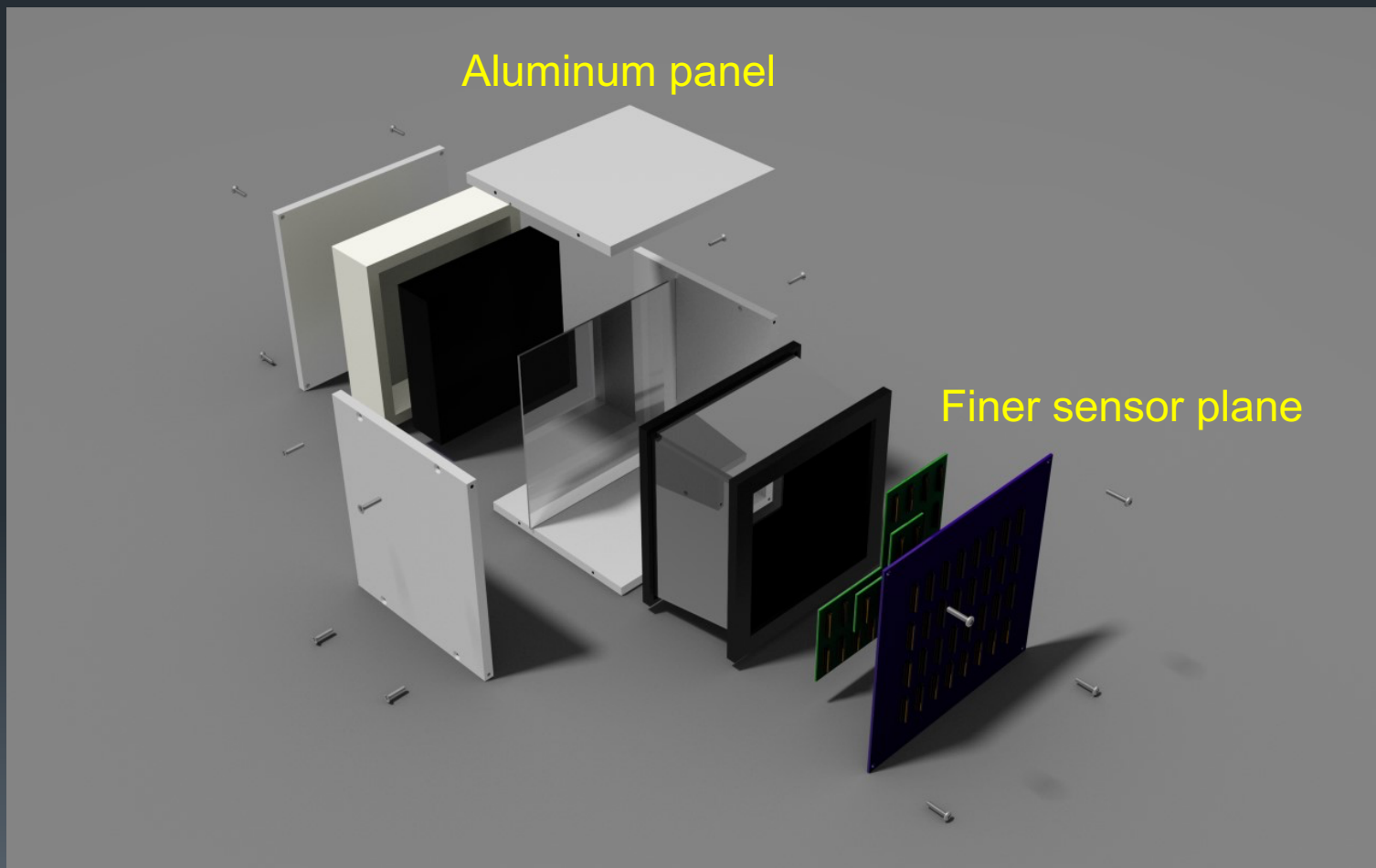
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Newer Design is Underway



Summary

- Lots of progress of mRICH R&D have been made both from the simulation studies and from the beam test. It is a great comfort to be able to verify the simulation with real beam particles.
- An improved detector design is underway with finer photosensors.
- More study will (could) be done within the context of an EIC detector system.
- The data analysis of the first beam test is ongoing and the plan is to publish the results within one year period.
- Prototype demonstrated the technology choices of RICH detectors for EIC experiment.

THANKS!